

Remarks

Applicants request reconsideration of the claims now pending in the application as amended above.

Claims 1, and 3-6 remain in the application.

The specification is objected to for failure to provide proper antecedent basis for the term "axle efficiency" as recited in claim 1. Claims 1 and 6 have been amended to refer to higher fuel efficiency instead of axle efficiency. This amendment is also intended to address the claim objection noted in the fifth paragraph of the Office Action, wherein the Examiner suggested that the term "a higher axle efficiency" should be referred to as – a higher fuel efficiency –.

Claims 1-4 stand rejected under 35 U.S.C. § 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which Applicants regard as the invention. In response to this rejection, claim 1 has been amended to delete the reference to "a low surface roughness" and instead now claims an average surface roughness of 4-7 microinches. Claim 1, at lines 11-12, recites the term " a higher axle efficiency" that has been amended to instead refer to a higher fuel efficiency. Claim 2 is rejected to as reciting the term "a mirror finish." In response, Applicants have cancelled claim 2 in view of the amendment to claim 1 specifying an average surface roughness of 4-7 microinches.

Claims 1-4 and 6 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Japanese Patent No. JP 63007221 (JP '221) in view of U.S. patent application Publication No. 2002/0088773 to Holland et al. Applicants object to the Examiner's citation of JP '221 without furnishing a complete translation of the reference so that it may be understood by Applicants. The Abstract relied upon states as follows:

After cutting the teeth, the gear is hardened. After removing the strain due to hardening, it is chemically ground, and finally it is finished by surface-treatment.

USE - The tooth surface is made much smoother, which means lubricating oil always exists between the teeth.

The title of the JP '221 is "Manufacture Ring Gear Drive Pinion." The JP '221 patent, to the extent that it is understood from the limited disclosure available, fails to disclose providing a ring gear and a pinion gear of a vehicle that is super-finished to an average surface roughness of 4-7 microinches. The JP '221 patent also fails to identify the problem discovered by Applicants that providing a ring gear and a pinion gear that has normal surface roughness can adversely affect vehicle fuel efficiency. The degree of fuel efficiency improvement achieved is now specified in amended claim 3, which states that fuel efficiency of the vehicle may be improved by 0.45 % miles per gallon in FTP metro or highway fuel efficiency cycles. As the Examiner admits, the JP '221 Abstract does not disclose the teeth of the ring gear and the teeth of the pinion gear are super-finished to a surface finish of 4-7 microinches.

The Examiner relies upon Holland 2002/0088773 A1, and in particular paragraphs 1, 2 and 20-25. While the Holland publication discusses importance of super-finishing mechanical articles for cosmetic purposes and/or for mechanical functioning purposes, Holland does not identify the problem solved by Applicants' invention. The fuel efficiency problem identified by Applicants was solved by super-finishing the teeth of a ring gear and a pinion gear in a vehicle gear set. The Holland publication actually teaches away from the method claimed in claim 6, wherein ceramic pebbles are used in a first vessel with an acid solution to remove film from the pinion gear and ring gear which is then followed by placing the ring gear and pinion gear in a second vessel containing a solution to neutralize the acidic solution used in the first vessel. In contrast, the Holland publication at paragraph 25 suggests that plastic media might serve their purposes better than the ceramic media.

Applicants object to the Examiner's assertion that Holland inherently provides low surface roughness and improved fuel efficiency. The only basis for the Examiner's

unsupported inherency position is Applicants' claims. Regarding claim 4, the Examiner admits that Holland does not disclose or mention a break-in coating. Instead, the Examiner merely assumes that super-finished gears are not provided with a break-in coating. Again, the Examiner's assumption is not justified, nor is it acquiesced by the Applicants. The Examiner's reference to paragraphs 1 and 2 of Holland that it would be obvious to modify the teachings of JP '221 in view of Holland for the purpose of improving performance as well as the life span of the gears. However, the Holland reference does not suggest super-finishing of the gears to solve the problem that Applicants have recognized of improving fuel efficiency. Applicants' proposed solution is the focus of Applicants' amended claims. Instead, the Holland publication focuses on refining the surfaces of metal articles for cosmetic or mechanical functioning purposes, and in paragraph 2, states:

Examples of mechanical parts with critical working surfaces include splines, crankshafts, camshafts, bearings, gears, couplings, and journals. For these parts, poor surface contact performance caused by lines can increase friction, torque, noise, vibration, operating temperature, and impair lubricity, and negatively impact failure in areas of wear, scuffing, plastic deformation, and contact fatigue and/or bending fatigue. For gears or other parts placed in a demanding environment such as the drive train of a helicopter or racing car, resistance to these types of failures in effect defines the useful life of the article.

No mention is made in the Holland reference of improved fuel efficiency. It is respectfully submitted that in view of the importance placed upon fuel efficiency in vehicles, Applicants' observation of the advantages that can be achieved by super-finishing the pinion gear teeth and ring gear teeth of a vehicle gear set should not be understood as being obvious in view of the references relied upon by the Examiner.


Claim 5 stands rejected under 35 U.S.C. § 103(a) as being unpatentable over JP '221 in view of Holland and further in view of U.S. Patent No. 6,732,606 to Zhu et al. The Zhu patent discloses that optimum gear surface finish is between 5 microinches and 10 microinches Ra. The purpose of providing a 5-10 microinch Ra surface finish as stated in the Zhu patent is that providing reduced surface roughness results in increased contact fatigue life,

improved wear resistance and improved performance. The Zhu patent does not disclose or suggest a solution to the problem discovered by Applicants that by providing a pinion gear and ring gear of a gear set for a vehicle with teeth that are super-finished to an average surface roughness of 4-7 microinches can lead to improved fuel efficiency of 0.45% in relevant test cycles. Zhu instead focuses on the life of the gears and maintaining adequate lubrication. The Zhu patent also does not disclose or suggest that a ring gear and pinion gear with a super-finished surface finish need not be provided with a break-in coating before being used in a vehicle as claimed by Applicants' in claim 4.

Applicants respectfully request reconsideration of the claims of the application as amended. Applicants have amended the claims of the application to place this case in condition for allowance. The Examiner is respectfully requested to pass this case to issue.

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